THE SERGESTIDAE OF THE GREAT BARRIER REEF EXPEDITION

BY

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SYNOPSIS.

The paper gives the occurrence of two species of the genus *Lucifer* in the Great Barrier Reef area during the year July 1928–July 1929. *L. penicillifer* Hansen is by far the commoner species; it occurred with fair regularity throughout the year, the month of September excepted. Spermatophores were present, in the distal portion of one vas deferens only, practically throughout the year, suggesting that there is no fixed breeding period. *L. typus* H. M.-Edw. occurred in small numbers between the end of July and the end of November 1928 but the two species were seldom present at the same time.

INTRODUCTION

The Sergestidae of the Great Barrier Reef Expedition all belong to the subfamily Luciferinae which comprises the single aberrant genus *Lucifer* V. Thompson (= *Leucifer* H. Milne-Edwards). This genus was revised by Hansen (1919, pp. 48–65, pls. iv and v) who reduced the number of known species to three, adding that " all the remaining names in the literature must be cancelled for ever either as synonyms or as quite unrecognizable " (p. 50). In addition, he described three new species from the " Siboga " material. These six species fall into two groups, one with long eye-stalks comprising *L. typus* H. M.-Edwards and *L. orientalis* Hansen, the other with short eye-stalks including the remaining four species—*L. faxoni* Borradaile, *L. hanseni* Nobili, *L. intermedius* Hansen and *L. penicillifer* Hansen. Hansen also gives keys to the determination of the species in each group and good figures of the petasma of each male (1919, pp. 52–57 and pls. iv and v.).

Only two species are represented in the abundant material of the Great Barrier Reef Expedition, namely *L. typus* H. Milne-Edwards and *L. penicillifer* Hansen—in each the petasma agrees with Hansen's illustrations. The latter species is by far the more plentiful, over 1,350 specimens having been obtained at 48 Stations as against 67 of *L. typus* from 15 Stations. *L. penicillifer* occurred with fair regularity throughout the year from 27th July, 1928, to 17th July, 1929, except for the period between 24th August and 2nd October, 1928. *L. typus*, on the other hand, was present during the weeks when *L. penicillifer* seemed to be absent and, although it was obtained in small numbers between 30th July and 29th November, 1928, the two species were rarely present in the same hauls of the townets (Stations 2, 8, 15 and 21).

Dakin and Colefax (1940, pp. 149–150) record only two species from the coastal waters of New South Wales, namely *L. typus* and *L. hanseni* Borradaile. Here the former species is stated to be rare, the latter being much more common. The pair of tiny spinules near the distal end of the ventral margin of the last abdominal somite in the female of *L. hanseni* figured by Dakin in fig. 241*a* is present also in *L. typus* and in *L. penicillifer*.

Note—The males frequently have a spermatophore in the distal portion of either the left or the right vas deferens; to avoid repetition these males are listed under each Station as "adult males." Special mention is made only of specimens in which the spermatophore was protruding from the genital opening of the male, or from the thelycum of the female.

Family Sergestidae.

Subfamily Luciferinae.

Genus *Lucifer* Vaughan Thompson.

Lucifer, J. Vaughan Thompson, 1829, p. 58, pl. vii, fig. 2.
Lucifer, H. J. Hansen, 1919, p. 48.
Leucifer, H. Milne-Edwards, 1837, p. 467; Barnard, 1950, p. 644.

Group A.—Eye-stalk Long.

Lucifer typus H. Milne-Edwards.

Leucifer typus H. Milne-Edwards, 1837, p. 469.
Lucifer typus, Hansen, 1919, p. 53, pl. iv, figs. 6*a*–6*k*; also references and synonymy.
(*non Leucifer typus* Stebbing 1914, p. 28 which = *L. penicillifer*).
Lucifer typus, Edmondson, 1925, p. 5; Cecchini, 1928, p. 52; Zariquiey, 1946, p. 58, fig. 58; Hiatt, 1947, p. 241–2.

Occurrence:

St. 2, 30.vii.28. 3 miles east of Low Islands. 1 metre stramin net. 1 adult and 1 immature ♂ (with *L. penicillifer*).
St. 8, 24.viii.28. 16° 30′ S., 145° 52′ E. (Trinity Opening). 1 metre stramin net. 1 ♀ (with *L. penicillifer*).
St. 9, 31.viii.28. 3 miles east of Low Islands. 1 metre stramin net. 1 ♂.
St. 11, 6.ix.28. 16° 24′ S., 145° 52′ E. (Trinity opening). 1 metre stramin net. 2 ♀ and one incomplete ♀ minus head region.
Coarse silk townet. 1 ♀.
St. 12, 11.ix.28. 3 miles east of Low Islands. 1 metre stramin net. 1 ♀, 3 adult ♂ (one has the spermatophore projecting from the genital duct) and 3 immature ♂.
St. 13, 20.ix.28. 3 miles east of Low Islands. 1 metre stramin net 2 ♀ and 6 young, 1 adult ♂
St. 13. Fine Silk International net. 1 ♀.
,, Coarse Silk International net. 2 immature ♂.
St. 14, 26.ix.28. 3 miles east of Low Islands. 1 metre stramin net. 1 immature ♂,
,, Coarse silk townet. 1 ♀, 1 immature ♂.

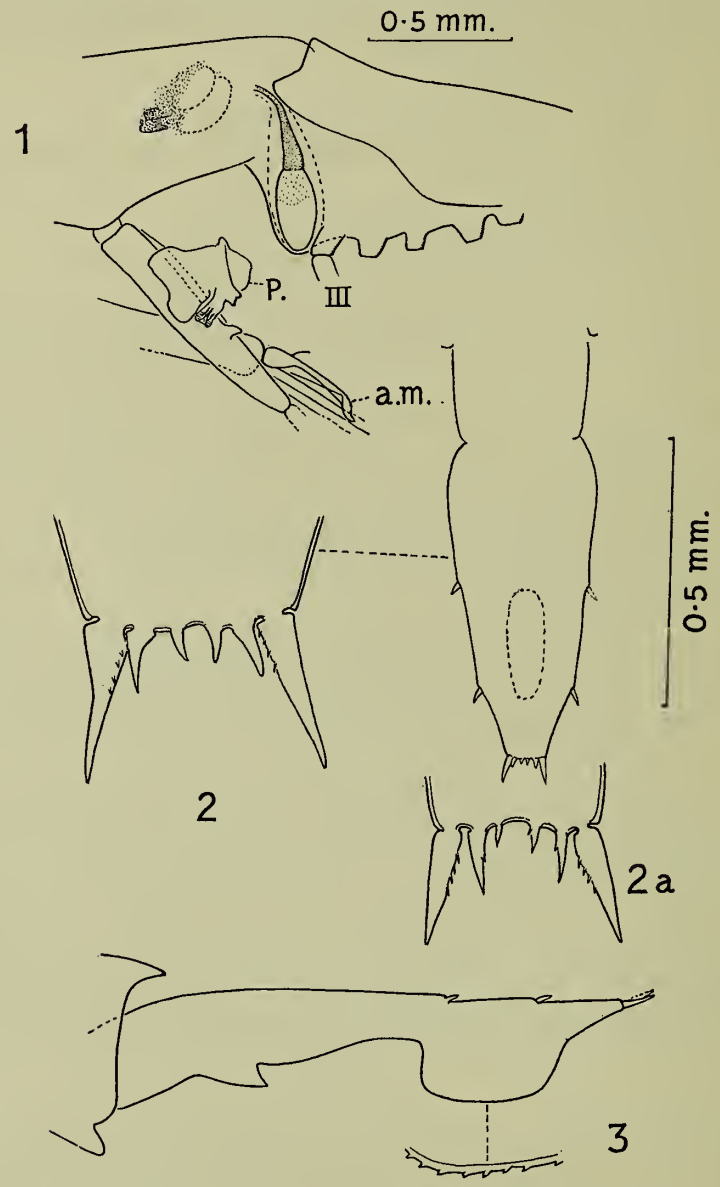
St. 15, 2.x.28. 3 miles east of Low Islands. Coarse silk townet, 1♀ (with *L. penicillifer*).
,, 1 metre stramin net. 1 ♀.
St.16, 3.x.28. 3 miles east of Low Islands. Closing coarse silk townet. Surface. Horizontal haul. 2 ♀.
,, II. 10 m. (Vert. dist.) 1 ♀.
,, III. 20 m. (Vert. dist.) 1 immature ♂.
St. 18, 15.x.28. 3 miles east of Low Islands. 1 metre stramin net. 2 ♀.
,, Coarse silk townet. 1 ♀.
,, Fine silk townet. 2 ♀, 1 young.
St. 19, 20.x.28. 16° 20′ S., 146° 3′ E. (outside Trinity Opening). 1 metre stramin net. 1 immature ♀.
St. 20, 20.x.28. 16° 19′ S., 146° 7′ E. (outside Trinity Opening). Coarse silk townet. 1 ♀.
St. 21, 22.x.28. 3 miles east of Low Islands. Fine silk townet. 1 ♀ (with *L. penicillifer*).
St. 28, 23.xi.28. 16° 19′ S., 146° 5′ E. (outside Trinity Opening). 1 metre stramin net. 5 ♀, 3 adult and 1 immature ♂.
,, Coarse silk townet. Tube broken—1 ♀ and 1 immature ♂ adhering to sides of tube.
St. 29, 29.xi.28. 16° 17′ S., 146° 2′ E. (outside Trinity Opening). Bottom stramin net. 6 ♀ and young (one ♀ with empty spermatophore case projecting from the thelycum); 3 adult and 2 immature ♂.

Recorded Distribution.—This species is very common in the warmer parts of the Atlantic Ocean—southern parts of the Gulf Stream, Sargasso Sea, North and South Equatorial Currents and Guinea Current—see map given under the specific name *L. reynaudi* by Ortmann (1893, Tafel x). The most southern Atlantic records are 28° 43′ S., 25° 14′ W. and 40° 32′ S., 52° 2′ W. It is rather rare in the Bay of Bengal and in the Pacific Ocean from the Great Barrier Reef area to Manilla. *L. orientalis* Hansen is much commoner in the Pacific and Indian Oceans but writers prior to Hansen (1919) did not realize that these two species are distinct and many of the earlier records of *L. typus* or its synonyms refer to *L. orientalis*.

Remarks.—Hansen, 1919, p. 52, states that females of *L. typus* are not easily distinguishable from those of *L. orientalis*. All the males in the present collection agree with Hansen's figures and description of *L. typus* as regards the telson and the petasma, which possesses a long-stalked hook, so it is reasonable to suppose that the females belong to the same species. The telson of the male is represented, in dorsal and in lateral aspect, in figs. 2 and 3 respectively. The large ventral cushion (which is lacking in the female and in immature males) is situated some distance from the apex; beyond the distal pair of lateral spines the telson narrows rather abruptly and the apex bears 3 pairs of spines. The longest pair are shorter than the width of the apical margin of the telson and each has 4 spinules on the proximal half of the inner side.

Burkenroad (1934, pp. 133–134) found a great preponderance of males in his material of *L. faxoni* Borradaile; he thought that the females probably mate with two males since only one spermatophore is formed at a time. Although the present samples of *L. typus* are

small, the total number of specimens being only 67, the sexes appear to be almost equally well represented—if anything the females are slightly in excess of the males. Text-fig. 1 represents part of the thorax and first abdominal somite of a male from St. 29, which has



Text-figs. 1–3.—*Lucifer typus* (H. M.-Edw.). (1) Posterior part of thorax and first abdominal somite of a male from St. 29, in lateral aspect, showing fully formed spermatophore in distal part of right vas deferens and two developing spermatophores in abdominal parts of the vasa deferentia. *p.*, Petasma ; *a.m.*, appendix masculina ; III, base of third pereiopod. (2) Telson of male, in dorsal aspect, with apex more highly magnified. (2*a*) Apex of telson of another specimen, highly magnified. (3) Telson of male, in lateral aspect.

been stained with lignin pink and mounted in polyvinyl-lacto-phenol. The contents of the spermatophore reacted in three ways to the stain, becoming dark red in the stalk or neck, pinkish-white in the distal two thirds of the flask and rather brownish in between. In the abdominal region of the vasa deferentia the contents of two other spermatophores are being assembled. The oval areas indicated by broken lines, the " gelbe Secretmasse "

of Rosenstadt (1896, Taf. 33, fig. 41) stain pinkish-white like the distal part of the flask; the larger developing spermatophore seems to belong to the left, the smaller to the right, vas deferens, suggesting that the two sides function alternately. In Text-fig. 1 the position of the petasma and of the appendix masculina on pleopod 2 is shown; Bargmann (1937, p. 346) thinks that in *Euphausia superba* Dana the spermatophore is received by the modified portions of the second pair of pleopods and passed to the first pair of pleopods (petasma) during copulation. When males are found with the spermatophore protruding from the vas deferens, as they sometimes are, this is doubtless due to the shock received by fully ripe specimens at the time of fixation. Many years ago I figured what I called spermatophores in *Euryrhynchus wrzesniowskii* Miers, but these are undoubtedly artefacts; the males must have been very ripe at the time of fixation and the shock of sudden immersion in the fixative must have caused emission of the seminal fluid, which hardened into irregular lumps (Gordon, 1935, p. 333, Fig. 18*a–e*). I know of no species of the Caridea having spermatophores of the kinds usually found in Euphausiacea and in the Peneidea, to which the Sergestidae belong. Unfortunately this mis-statement of mine has been repeated by Dr. Balss in his recent monumental work, now nearing completion, namely the Decapoda in Bronn's Klassen und Ordnungen des Tierreichs (Balss, 1944, Lief. 5, p. 619).

Group B.—Eye-stalk Short.

Lucifer penicillifer Hansen.

Lucifer penicillifer Hansen, 1919, p. 59, pl. v, figs. 2 *a–k*.
Leucifer penicillifer, Barnard, 1950, p. 645, fig. 121.
Leucifer typus Stebbing, 1914, p. 28—see Barnard, 1947, p. 384.

Occurrence:

St. 1, 27.vii.28. 3 miles east of Low Islands. 1 metre stramin net. About 30 specimens, ♀, ♂ and young.
,, Coarse silk net. 8 ♀ and young, 5 ♂.
St. 2, 30.vii.28. 3 miles east of Low Islands. 1 metre stramin net. 10 ♀, 6 adult ♂, 6 young (with *L. typus*).
,, Coarse silk net. 1 ♀, 4 adult ♂.
St. 3, 4.viii.28. 3 miles east of Low Islands. 1 metre stramin net. (Tube broken, but some specimens adhering to sides.) 8 ♀ and young, 2 adult ♂.
,, Coarse silk net. 2 ♀, 2 adult ♂, 2 young.
St. 4, 7.viii.28. 1 mile north of Low Islands. Coarse silk townet. 3 ♀, 2 adult and 1 immature ♂.
St. 5, 11.viii.28. 3 miles east of Low Islands. 1 metre stramin net. 10 ♀, 14 adult ♂ (2 with spermatophore projecting from ejaculatory duct), 6 young ♂, 3 young ♀.
,, Coarse silk net. 8 ♀, 9 ♂, 3 young.
St. 6, 17.viii.28. 3 miles east of Low Islands. 1 metre stramin net. 10 ♀, 1 young and 5 adult ♂ (one with spermatophore projecting from duct).
,, Coarse silk net. (Tube broken.) 1 ♀, 1 ♂.
St. 8, 24.viii.28. 16° 30′ S., 145° 52′ E. (Trinity Opening). 1 ♀ with *L. typus*.

St. 15, 2.x.28. 3 miles east of Low Islands. Coarse silk net. 1 ♂, with *L. typus*.

St. 21, 22.x.28. 3 miles East of Low Islands. 1 metre stramin net. 2 ♀, 2 adult ♂ (part of stalk of spermatophore projecting from duct of one ♂, the rest may have been broken off).

,, Coarse silk townet. 2 ♀.

,, Fine silk townet. 1 ♀, with *L. typus*.

St. 23, 2.xi.28. 3 miles east of Low Islands. Coarse silk townet. 2 ♀.

St. 24, 6.xi.28. 3 miles east of Low Islands. Coarse silk townet. 1 slightly immature ♀, 1 ♂.

St. 25, 16.xi.28. 16° 19′ S., 146° 5′ E. (outside Trinity Opening). Coarse silk townet. (Tube broken.) 1 immature ♀, 1 ♂ adhering to plug of cotton wool.

,, 1 metre stramin net. (Tube broken, specimens missing) ?

St. 27, 21.xi.28. 3 miles east of Low Islands. 1 metre stramin net. 1 ♀.

St. 30, 28.xi.28. 3 miles east of Low Islands (outside Trinity Opening). 1 metre stramin net. 5 ♀, 2 young ♂.

St. 30*a*, 29.xi.28. Coarse silk townet. 5 ♀, 3 adult ♂.

St. 31, 3.xii.28 (or 2.xii). Bottom stramin net. About 30 specimens, ♀, ♂ and young.

St. 32, 5.xii.28. 3 miles east of Low Islands. 1 metre stramin net. 1 ♀.

St. 33, 14.xii.28. 3 miles east of Low Islands. 1 metre stramin net. 2 ♀ (one slightly immature), 1 adult and 2 young ♂.

St. 34, 19.xii.28. 3 miles east of Low Islands. 1 metre stramin net. 10 specimens, ♀, ♂ and young.

,, Coarse silk net. 16 ♀ and young, 3 ♂.

St. 35, 27.xii.28. 3 miles east of Low Islands. 1 metre stramin net. About 35 specimens, ♀, ♂ and young; a few of the males are adult.

,, Coarse silk townet. 9 ♀ and young, 5 ♂.

St. 36, 4.i.29. 3 miles east of Low Islands. 1 metre stramin net. 15 ♀ and young, 5 ♂.

,, Coarse silk net. 10 ♀ and young, 5 immature ♂.

St. 37, 14.i.29. 3 miles east of Low Islands. 1 metre stramin net. 30 specimens, mostly ♀ and young, a few rather immature ♂.

,, Coarse silk townet. 20 specimens, ♂ (a few adult), ♀ and young.

St. 38, 21.i.29. 3 miles east of Low Islands. 1 metre stramin net. 15 ♀ and young, 5 ♂.

St. 39, 30.i.29. 3 miles east of Low Islands. 1 metre stramin net. About 50 specimens, ♀ and young, and ♂ (some adult; one with spermatophore projecting from duct).

,, Coarse silk townet. 16 ♀ and young, 2 adult and 2 immature ♂.

St. 40, 6.ii.29. 3 miles east of Low Islands. 1 metre stramin net. 14 ♀ and young, 8 ♂ (mostly adult).

,, Coarse silk townet. About 50 specimens, mostly ♀ and young (one ♀ has a spermatophore projectiong from the thelycum); 8 are ♂, but not all are fully grown.

St. 42, 18.ii.29. 3 miles east of Low Islands. 1 metre stramin net. 6 ♀ and young, 3 ♂.

,, Coarse silk townet. 22 specimens, ♀, ♂ and young.

St. 43, 26.ii.29. 15° 16′ S., 145° 26′ 30″ E. (off Cape Bedford). 1 metre stramin net. 22 ♀ and young, 8 ♂—some rather young.

,, Coarse silk townet. 10 ♀ and young, 8 ♂, mostly adult.

St. 44, 27.ii.29. 14° 44′ S., 145° 27′ 30″ E. (off Lizard Island). 1 metre stramin net. 10 ♀, 10 ♂—most of the specimens rather immature.

,, Coarse silk townet. 30 specimens, ♀, young, and rather immature ♂.

St. 45, 28.ii.29. 14° 31′ S., 145° 35′ E. (outside Cook's Passage). 1 metre stramin net. Vertical haul, 500 metres of wire out. 8 ♀ and young, 2 young ♂.

,, Coarse silk townet. 4 ♀ and young.

St. 46, 28.ii.29. 14° 31′ S., 145° 35′ E. (outside Cook's Passage). 1 metre stramin net. 28 specimens, mostly ♀ and young, about 8 are ♂.

,, Coarse silk townet. 35 specimens, ♀, young and adult ♂ (one ♂ has the spermatophore projecting from the genital duct).

St. 47, 4.iii.29. 3 miles east of Low Islands. 1 metre stramin net. 11 ♀ and young, 4 ♂ (one with spermatophore projecting from duct.)

,, Coarse silk townet. 2 ♀, 2 ♂.

St. 48, 15.iii.29. 3 miles east of Low Islands. Coarse silk townet. 2 ♀, 1 immature ♂, 3 young.

,, 1 metre stramin net. 22 ♀ (three have each one spermatophore projecting from the thelycum), 17 adult and young ♂, 15 young specimens.

St. 49, 17.iii.29. 15° 47′ S., 145° 41′ E. (inside Papuan Pass). 1 metre stramin net. 20 specimens, ♀, ♂ and young.

,, Coarse silk townet. 15 ♀ and young, 5 ♂.

St. 50, 18.iii.29. Outside Papuan Pass. 1 metre stramin net. 2 ♀, 2 adult and 1 immature ♂.

St. 51, 25.iii.29. 3 miles east of Low Islands. 1 metre stramin net. 15 ♀ and young, 7 ♂ some immature.

,, Coarse silk townet. 4 ♀ and young.

St. 52, 6.iv.29. 3 miles east of Low Islands. 1 metre stramin net. 8 ♀ and young, 2 adult and 2 immature ♂.

,, Coarse silk townet. 9 ♀ and young (one ♀ with an empty spermatophore case projecting from the thelycum), 1 ♂.

St. 53, 13.iv.29. 3 miles east of Low Islands. 1 metre stramin net. 9 ♀ and young, 2 adult and 2 rather immature ♂.

,, Coarse silk townet. 15 ♀ and young, 11 ♂ some of which are not fully grown.

St. 54, 20.iv.29. 3 miles east of Low Islands. 1 metre stramin net. 27 ♀ and young, 2 adult and 1 immature ♂.

,, Coarse silk townet. 16 ♀ and young (one ♀ with spermatophore projecting from thelycum), 4 ♂.

St. 55, 26.iv.29. 3 miles east of Low Islands. 1 meter stramin net. 30 specimens, mostly ♀ and young, a few immature ♂.

St. 55, Coarse silk townet. 30 ♀ and young, 7 adult and 6 immature ♂.
St. 56, 7.v.29. 3 miles east of Low Islands. 1 metre stramin net. 3 ♀, 11 young, 7 adult ♂ (the spermatophore projecting from the duct in two ♂).
,, Coarse silk townet. 18 ♀ and young, 8 ♂.
St. 57, 18.v.29. 3 miles east of Low Islands. 1 metre stramin net. 20 specimens—adult ♀, and ♂, and young (one ♂ has the spermatophore projecting from the duct).
,, Coarse silk townet. 2 ♀, 4 adult ♂ (one ♂ with the spermatophore projecting from the duct).
St. 58, 25.v.29. 3 miles east of Low Islands. Coarse silk townet. 5 ♀ and young, 5 adult ♂ (2 each with a projecting spermatophore), 1 immature ♂.
St. 59, 31.v.29. 3 miles east of Low Islands. 1 metre stramin net. 12 ♀ (one with two large ova attached to right pereiopod III, the other ova presumably had been shaken off), 6 adult ♂, 3 young.
,, Coarse silk townet. 17 specimens, ♀, adult ♂ and young.
St. 60, 7.vi.29. 3 miles east of Low Islands. 1 metre stramin net. 11 ♀ and young, 3 adult ♂ (one with the spermatophore projecting from duct), 1 immature ♂.
,, Coarse silk townet. 5 ♀, 5 ♂.
St. 61, 14.vi.29. 3 miles east of Low Islands. 1 metre stramin net. 12 ♀ and young, 8 adult and 4 immature ♂.
,, Coarse silk townet. 8 ♀ and young, 4 adult and 2 immature ♂.
St. 63, 24.vi.29. 3 miles east of Low Islands. 1 metre stramin net. 11 ♀ and young, 7 adult and 2 immature ♂.
,, Coarse silk townet. 8 ♀ and young, 6 adult and 2 immature ♂
St. 66, 11.vii.29. 3 miles east of Low Islands. 1 metre stramin net. 5 ♀ and young, 2 adult, 2 immature ♂.
,, Coarse silk townet. 5 ♀, 8 adult and 1 immature ♂.
St. 67, 17.vii.29. 3 miles east of Low Islands. 1 metre stramin net. 5 ♀, 5 ♂.
,, Coarse silk townet. 7 ♀ and young, 5 ♂.

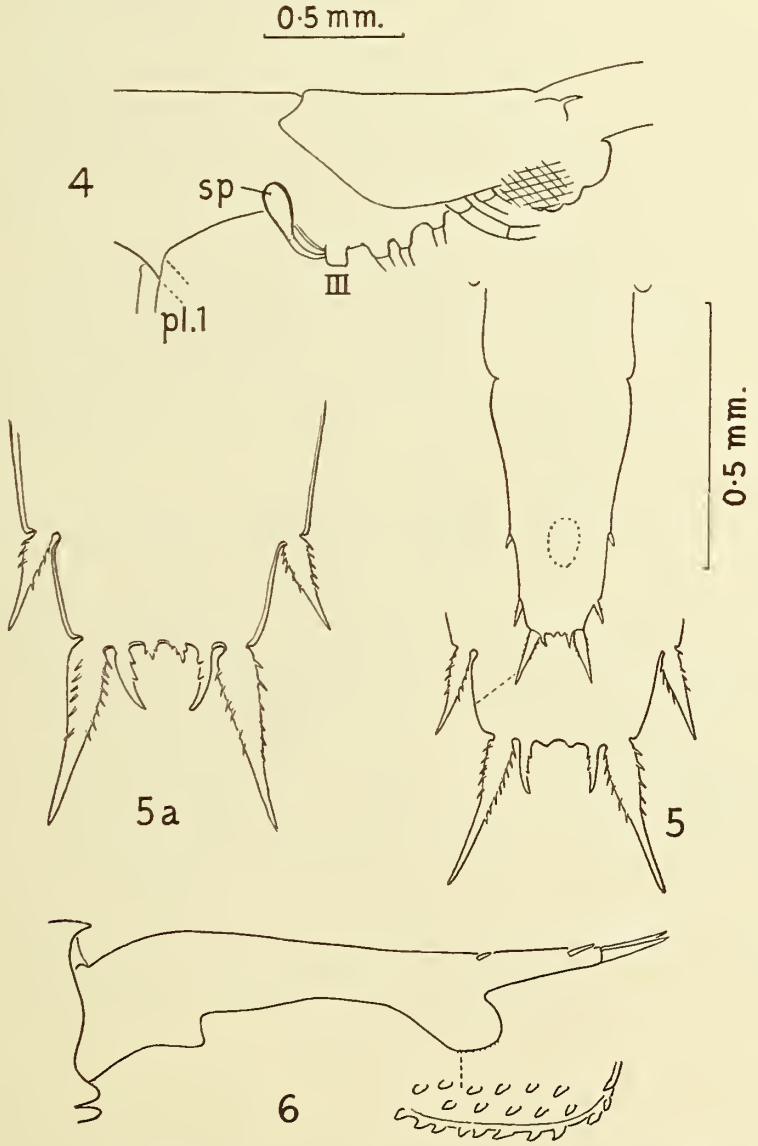
Recorded Distribution.—Common in the Dutch East Indies area explored by the "Siboga" Expedition, and in the Great Barrier Reef area. Other localities mentioned by Hansen are Bay of Bengal, China Sea, Formosa Strait, Manilla and Gulf of Yedo.

Remarks.—The telson of the male is represented in dorsal aspect in Text-fig. 5 and in lateral aspect in Text-fig. 6. The protuberance or cushion on the ventral surface is much smaller than that of *L. typus* and is situated further from the apex of the telson. The distal pair of lateral spines are situated nearer to the apex, are larger and beset with spinules on the proximal half of either side (*cf.* Text-figs. 2 and 3 with 5 and 6). The median pair of apical spines is poorly developed but the outer pair are equal to, or rather longer than, the width of the apical margin and have 5 to 8 spinules on each side.

Owing to the small size and extreme lateral compression of the specimens it is by no means easy to detect the genital openings in either sex. Early writers thought that, as an adaptation to the compression of the body, there was a median unpaired opening in each sex. Brooks, however, corrected this in his classic study of the morphology and development of *Lucifer* (Brooks, 1882, p. 58) in the case of the male in which he found that the vasa deferentia are equally well developed on both sides. In the female he thought that

there was but one duct and one receptaculum seminis opening medially on the thoracic sternum.

Even as late as 1927 Balss states that, in the subfamily Luciferinae " Geschlechtsöffnungen unpaarig " is one of the characters (Kükenthal & Krumbach's Handbuch der Zoologie, p. 1000). He has corrected this statement in his recent volume dealing with Crustacea Decapoda in Bronn's Klassen und Ordnungen des Tierreichs (1944, Lief. 5, pp. 595 and 627–8). In the Great Barrier Reef collection most samples include adult males; right and left vasa deferentia are equally developed, although only one is (as already mentioned on p. 327) functional at a time. When the spermatophore projects from the duct, as it does in some specimens, it is seen to lie slightly to one side of the median line thus proving the presence of two openings.



Text-figs. 4–6.—*Lucifer penicillifer* Hansen. (4) Thorax and first abdominal somite of a female from St. 52, in lateral aspect, showing an empty spermatophore case inserted into thelycum. *sp.*, Spermatophore case; III, base of third pereiopod; *pl.* 1, first pair of pleopods. (5) Telson of male, in dorsal aspect, with apex more highly magnified. (5*a*) Apex of telson of another specimen, highly magnified. (6) Telson of male, in lateral aspect.

Burkenroad (1934, p. 133) says that the genital ducts of the female " appear to open on the postero-median surface of the coxae of pereiopods III in a position equivalent to that in *Acetes*. . . . The paired pear-shaped, sac-like sperm receptacles lie side by side in the protruding posterior part of the perionic sternum, which they fill in impregnated females. The sacs open separately between the third pair of legs into a common atrium formed by a median depression of the sternum." I have sometimes detected the paired female genital openings on the coxae of pereiopods III. When a spermatophore case is present it is inserted firmly by its narrow neck into the thelycum between pereiopods III (the last pair in *Lucifer*, IV and V being absent) see Text-fig. 4. Rosenstadt (1896, Taf. 35, figs. 56–59), who figured a cross section of the thelycum and longitudinal sections of three developmental stages, apparently mistook this structure for the supposed median genital opening or vagina as he called it. None of his sections passes through the place where a receptaculum seminis communicates with the narrow cavity which lies between the developing thelycal plate and the sternal wall. His fig. 56, which Dr. Bargmann who studied the structure and development of the thelycum in *Euphausia superba* (1937, pp. 342–346) considers not quite accurate, shows one receptaculum seminis full of spermatozoa, the other empty : in a hermaphrodite which functioned as a male an incipient thelycum is present on the sternum immediately anterior to the vas deferens with its spermatophore (Rosenstadt's fig. 60). Kishinouye (1928, lower right hand figure on p. 126) figures the thelycum which he describes as consisting of " a single median invagination, opening with a longitudinal slit, and protected behind by a triangular plate." The morphology and development of the male and female reproductive systems of *Lucifer* require more critical study and there is sufficient material of *L. penicillifer* for this purpose if it is sufficiently well preserved for histological work.

Burkenroad saw no females with projecting spermatophores but thought that the female probably receives one from each of two separate males, the contents of one sufficing to fill one sperm sac. Certainly females of *Euphausia superba* may have up to seven spermatophore cases in the thelycum, although two is the normal number (Bargmann, 1937, p. 347). No female of *L. penicillifer* in the abundant Barrier Reef material has more than one spermatophore and Brooks did not find more than one (1882, p. 60) in the species studied by him. Nor is there a marked preponderance of males over females in the 1,350 specimens of *L. penicillifer* (*cf.* Burkenroad, 1934, p. 134). Since the ova are few in number the contents of one spermatophore should suffice ; perhaps the adaptation to the extreme bodily compression is that one spermatophore at a time is ample for the propagation of the species. Brooks (1882, pl. 9, fig. 74, and p. 60) shows the eggs " attached, in a loose bunch of twenty or more, to the last pair of thoracic limbs." Only one female in the Barrier Reef material had attached ova, two were adhering to pereiopod III and another was loose in the tube. They are certainly easily detachable and it is doubtful whether they actually remain attached to the parent for the 36 hours required for the development of the nauplii which emerge.

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